

Permutations. Given two integer arrays of size N , design a subquadratic algorithm to determine whether one is a permutation of the other. That is, do they contain exactly the same entries but, possibly, in a different order.

Stack with max. Create a data structure that efficiently supports the stack operations (push and pop) and also a return-the-maximum operation. Assume the elements are real numbers so that you can compare them. All operations must complete in constant time.

Detect cycle in a linked list. A singly-linked data structure is a data structure made up of nodes where each node has a pointer to the next node (or a pointer to null). Suppose that you have a pointer to the first node of a singly-linked list data structure:

- Determine whether a singly-linked data structure contains a cycle. You may use only two pointers into the list (and no other variables). The running time of your algorithm should be linear in the number of nodes in the data structure.
- If a singly-linked data structure contains a cycle, determine the first node that participates in the cycle. you may use only a constant number of pointers into the list (and no other variables). The running time of your algorithm should be linear in the number of nodes in the data structure.

You may *not* modify the structure of the linked list.